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(54) Multiple aliquot device.

(57) The present invention is a device which allows for receiving, distributing and storing a sample into numerous aliquots of small volume without air entrapment and with retention of aliquots when the device is manipulated. The device allows for the treatment of any or all of the aliquots with the same or different reagents and/or other chemical additives. The device comprises a housing for containing a body for guiding a sample into a plurality of wells without the need for pipetting aids, without multiple manipulations, without the retention of air and for retaining sample in the wells.

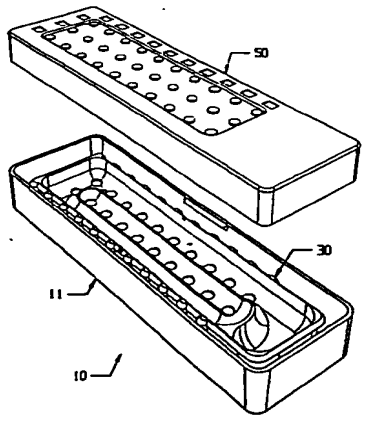

FIG. 1

EP 0 496 200 A2

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a device useful for receiving, distributing and storing aliquots of a sample for testing or analysis and is particularly useful in the sampling techniques employed in clinical microbiology applications.

2. Description of Related Art

There are many analytical methods in chemistry, clinical chemistry and microbiology where a liquid sample is divided into more than one aliquot and then tested or examined. Even in the case of a single analytical protocol, there are many instances where replicate tests may be run on multiple aliquots of the sample to assure reproducibility of the result. When undergoing analysis and characterization, aliquots of a single sample may be reacted with either a variety of different chemical reagents for analytical purposes or may be reacted with differing amounts of a single reagent or both.

Many approaches exist to aid in the preparation of aliquots of a single sample. A common example of such a situation exists in the modern practice of clinical microbiology. An unidentified microorganism is routinely subjected to tests and procedures to determine its identity and/or pattern of resistance or susceptibility to destruction by a variety of antimicrobic chemicals. Commercial systems for such determination are provided by several manufacturers and typically use between 10 and 100 small aliquots of a sample suspension of the microorganism undergoing analysis. These systems require a variety of sterile vessels and pipetting aids for adequate filling when small physical amounts of aliquots are required. Therefore a need exists for a device and method for the preparation of sample aliquots that obviates the requirement for a variety of sterile vessels and pipetting aids.

A number of devices and containers are commercially available for the preparation of samples for analysis. For in vitro tests, disposable, multi-compartmental containers are provided by manufacturers in complete reagent kits. Immunoassays, which include the screening of blood samples for virus antibodies (e.g., the HIV or Hepatitis B virus), are commonly carried out in 96 well micro titration trays supplied precoated with appropriate reagents as part of a kit. Specialized equipment used in the preparation of samples for analysis is described in U.S. Patent Nos. 4,761,378; 4,496,657; 4,493,896; 4,342,407; 3,826,717; 4,154,795 and 4,200,613.

Pipetting devices for inoculation of multi-compartmental containers include the SCEPTORPETTE® System (trademark of Becton Dickinson and Company) sold by Becton Dickinson Microbiology Systems, Towson, Maryland and the device illustrated in U.S. Patent No. 4,532,805.

In clinical microbiology, there are a number of devices and containers available, having a plurality of small reaction chambers. Such devices include the SCEPTOR® Bacterial MIC and ID testing system (trademark of Becton Dickinson and Company) sold by Becton Dickinson Diagnostic Instrument Systems, Towson, Maryland, MINITEK™ Systems (trademark of Becton Dickinson and Company) sold by Becton Dickinson Microbiology Systems, Cockeysville, Maryland and the API20E® Identification Strip (trademark of Sherwood Medical) sold by Analytab Products, Division of Sherwood Medical, Plainview, New York.

Devices for manipulating liquid samples containing microorganisms for use with multi-welled containers are described in U.S. Patent Nos. 4,548,245; 4,565,100; 4,239,853; 4,235,971; and 4,076,592.

Automated devices for microorganism identification and drug susceptibility testing include the commercially available VITEK™ system (trademark of Vitek Systems, Inc.) sold by Vitek Systems, Inc., Hazelwood, Missouri and the devices illustrated in U.S. Patent Nos. 3,957,583; 4,018,652; 4,116,775 and 4,207,394.

U.S. Patent No. 4,806,316 to Johnson, et. al. describes a device for use in exposing a sample to be tested to one or more test reactants. The Johnson et al. device comprises a docking port, a filling manifold, a vent control system and a filling channel. A specific feature of the device is that it uses complex flow paths for liquid and air.

A device comprising a planar surface with projections which align with the wells of a standard-type 96 well tissue culture plate is known in the art as shown in U.S. Patent No. 4,483,925 to Noack. The projections used in Noack are of an absorbent nature and are used to control the removal of liquid from the wells.

A commercially available system, the F.A.S.T.™ Immunoassay System (trademark of Becton Dickinson and Company) by Becton Dickinson Labware Products, Lincoln Park, New Jersey, provides simultaneous addition of a reagent to wells of a microtiter plate, however, each well of the microtiter plate is previously filled by pipetting steps.

Although there are a number of testing devices and pipetting systems available, there is no self-

contained system available to produce small aliquots of a sample without entrapment of air bubbles.

The available devices also do not allow easy error-free reading of reaction results visually or by instruments for accurate test results, particularly when covered. The available devices do not have the means to provide aliquots of predetermined volume in a single operation and are not able to conveniently or accurately introduce reagents or materials into each separate aliquot for analysis thereof.

Thus, a special need exists for a device and method for the convenient preparation of separate aliquots into efficient areas without entrapment of air that obviates the requirement for a variety of sterile vessels, pipetting aids and multiple manipulations.

SUMMARY OF THE INVENTION

The present invention is a device for dividing and filling sample into efficient aliquots without air entrapment and with retention of the aliquots. The device comprises a housing and a body for guiding a sample into a plurality of wells and for retaining the sample in the wells for testing and analysis.

In a preferred embodiment of the invention, the device comprises an outer-base element and a sample distribution element for dividing a sample into pre-determined volume aliquots.

The outer-base element preferably comprises a bottom, an inner planar surface, depending side walls and individual well bottoms raised from the inner planar surface.

The outer-base element preferably comprises a plurality of posts projecting from its inner planar surface and the sample distribution element may have a plurality of corresponding bosses depending from its lower surface. The bosses engage the posts thereby securing the outer-base element to the sample distribution element so as to form a device.

The sample distribution element provides for receiving, distributing, filling and holding sample material and comprises an upper surface, a lower surface, and a plurality of wells. The sample distribution element is associated with the outer-base element and the outer-base element preferably serves as the base to the sample distribution element.

A preferred embodiment of the sample distribution element comprises a means for containing and/or guiding the sample sequentially over the upper surface of the sample distribution element. This means is a trough which comprises a unidirectional pathway on the upper surface of the sample distribution element.

Another preferred embodiment of the sample distribution element comprises a means for receiving and/or distributing sample and/or for holding excess sample. This means is a reservoir area adjacent to the trough.

Each well is substantially disposed between the upper and lower surface of the sample distribution element and transversely disposed with respect to the trough. Each well comprises a sidewall, a sidewall bottom surface, an upper mouth opening and a bottom mouth opening. The bottom mouth opening and the sidewall bottom surface of each well corresponds with the well bottoms raised from the inner planar surface of the outer-base element.

Preferably, the upper mouth opening and the trough are substantially perpendicular to each other to form a substantially sharp junction. It is believed that the substantially sharp junction provides a means for separating individual aliquots from the sample.

Preferably, the bottom mouth opening and the sidewall bottom surface are substantially parallel to the well bottom to form a sufficiently spaced means between them so that air is expelled from the well and the aliquot easily fills into the well. It is believed that the weight of the sample forces the air in the well to be pushed through the spaced means. It is further believed that the combination of frictional forces, hydrostatic pressure differential and the sample surface tension prevents the aliquot from leaving the well or spaced means even when the device is manipulated or inverted. It is also believed that the spaced means allows the diameter of the individual wells to be of a substantially small size and to also allow the aliquot to easily fill into individual small wells without any restriction and without the need for pipetting aids.

The device preferably comprises a removable lid associated within the outer-base element and over the sample distribution element, which includes an upper and lower surface, depending sidewalls and a plurality of projections depending from its lower surface. The lid serves to prevent the loss of sample or aliquots from the device interior, to protect the contents of the device from the environment, to protect the user from the contents of the device should it contain a harmful or potentially harmful material such as a microorganism suspension and to provide a means for testing aliquots.

A majority of the projections on the lid are preferably arrayed, sized and shaped to fit within the upper mouth opening of each well in the sample distribution element.

Projections depending from the lid preferably are coated with materials to interact with the sample aliquot in the individual wells. Alternatively, one or more conduits may be on the upper surface of the lid

and connected to one or more of the projections. Materials may be added to wells via the conduits after the lid has been placed over the sample distribution element. Materials added to the wells by the conduit and the projections may be in addition to materials coated on the projections.

A preferred embodiment of the lid comprises means for absorbing excess sample in the reservoir of the sample distribution element which means is preferably a sponge or absorbent pad.

The preferable form of the device is a rectangular shape with the wells in an ordered array of parallel rows. The outer-base element and the lid are preferably made of an optically clear plastic to facilitate viewing of the wells. The sample distribution element is preferably made of an opaque color, most preferably white, so as to provide contrast and prevent interference of colored sample in the wells with one another.

The device preferably receives, divides and distributes a sample into individual wells that are of a substantially small volume comprising a small diameter and/or height for testing and/or analysis. A sample is provided in the reservoir of the sample distribution element and the wells are filled by tilting the device slightly so that the sample in the reservoir flows in the unidirectional pathway of the trough. Once the sample has traveled to the last well, the device can be tilted to make any excess sample travel back along the same pathway to the reservoir. This process assures that sample passes over the upper mouth of each well twice to ensure complete filling. As the sample flows from the opening of each well downward, air is expelled from the well through the spaced means between the sidewall bottom surface of the well and the well bottom. The substantially sharp junction of the upper mouth opening of each well and the trough provides a means for separating individual aliquots from the sample into the well.

Sample may enter the spaced means between the sidewall bottom surface of the well and the well bottom after air has been expelled, and it is believed that the combination of frictional forces, hydrostatic pressure differential and the sample surface tension prevents the sample from flowing beyond the spaced means between the sidewall bottom surface of the well and the well bottom. As excess sample continues in the trough, the aliquot is separated from the sample by the substantially sharp junction of the upper mouth opening of each well and the trough. The sample easily fills into each well and pushes air through the spaced means. The sample remains in the well and in the spaced means even when the device is manipulated or inverted.

The spaced means allows the aliquot to fill into individual wells of a small volume comprising a small diameter and/or height without any restriction.

The individual wells may be coated with dried reagents that are reconstituted with fluid from the sample or with immobilized reagents for solid phase tests. More preferably, additional wet or dry reagents may be coated on the projections depending from the lid. Upon covering of the device with the lid these additional reagents come into contact with the sample in the wells.

In accordance with the preferred embodiment of the present invention, the device is chemically isolated, and well-suited for use in clinical microbiology applications including, but not limited to, chemical, immunochemical and microorganism identification and antimicrobic sensitivity testing.

The device is disposable, self-contained and is able to produce aliquots of substantially small volume in a rapid manner without a variety of sterile vessels, pipetting or sampling aids and multiple manipulations.

The device solves the problem of filling an aliquot into a small volume comprising a small diameter and/or height, without the need for pipetting or sampling aids and multiple manipulations.

An advantage of the device is that it is able to allow isolation of sample aliquots so they may be reacted or modified in an individually selective manner. The multiple aliquots may be treated with the same or different reagents or other chemical additives.

A further advantage is that the device provides a convenient means for simultaneously and effectively inoculating a large number of individual wells of a small volume comprising a small diameter and/or height, without the need for multiple filling and distributing steps.

Another advantage of the device is that air is easily expelled from each well so that the sample may easily fill into each well and also so that the aliquot remains in the well even upon manipulating or inverting the device.

A further advantage of the device is that consistent results may be obtained when testing the sample because of the substantially equal, rapid and reproducible filling of each well, the substantially equal volume of all the aliquots and because air has been expelled from the wells during filling.

The device also allows for easy visual or machine examination of individual sample aliquots and reduces the total amount of starting sample required for use by allowing aliquots of a small volume to be distributed.

With the foregoing and additional features in view, this invention will now be described in more detail, and other benefits and advantages thereof will be apparent from the following description, the accompany-

ing drawings, and the appended claims.

DESCRIPTION OF THE DRAWINGS

A further understanding of the invention may be achieved by referring to the accompanying drawings, wherein:

FIG. 1 is a perspective view of the preferred embodiment of the invention illustrating the outer-base element connected to the sample distribution element with the optional removable lid not attached.

FIG. 2 is a perspective view illustrating the outer-base element.

FIG. 2(a) is a top view of the outer-base element of FIG. 2.

FIG. 3 is a perspective view illustrating the sample distribution element.

FIG. 3(a) is a top view of the sample distribution element of FIG. 3.

FIG. 3(b) is a bottom view of the sample distribution element of FIG. 3.

FIG. 4 is a partial cross-sectional side elevational view, illustrating the assembled components of the embodiment of FIG. 1.

FIG. 4(a) is an enlarged partial cross-sectional perspective view of the assembled components of the embodiment of FIG. 1, illustrating the well, the well bottom and the projections on the periphery of the well bottom.

FIG. 4(b) is an enlarged partial cross-sectional perspective view of the assembled components of FIG. 1, illustrating the well, the sidewall bottom surface and the projections on the periphery of the sidewall bottom surface.

FIG. 5 is a perspective view of the removable lid of FIG. 1 with a means for adsorption of sample.

FIG. 5a is a top view of the removable lid of FIG. 1.

FIG. 6 illustrates an optional embodiment of the removable lid comprising conduits.

DETAILED DESCRIPTION

While this invention is satisfied by embodiments in many different forms, there is shown in the drawings and will herein be described in detail preferred embodiments of the invention, with the understanding that the present disclosure is to be considered as exemplary of the principles of the invention and is not intended to limit the invention to the embodiments illustrated. Various other modifications will be apparent to and readily made by those skilled in the art without departing from the scope and spirit of the invention. The scope of the invention will be measured by the appended claims and their equivalents.

Referring to the drawings, there is illustrated a device according to the present invention for receiving, distributing and storing multiple aliquots of a sample to be tested or analyzed.

The preferred embodiment of device **10** comprises an outer-base element **11**, a sample distribution element **30** and a lid **50** as shown in FIG. 1.

Device **10** is typically, but not limited to, a rectangular shape with the wells in an ordered array of parallel rows. The outer-base element and the lid are preferably an optically clear plastic to facilitate viewing of the wells. The sample distribution element is preferably made of an opaque colored plastic, most preferably white plastic, to provide contrast and prevent interference of colored sample in the wells with one another.

The outer-base element **11** as shown in FIGS. 2 and 2(a) comprises a bottom **12**, an inner planar surface **14**, depending sidewalls **15, 16, 17** and **18**, shelf-like projections **20** and **21** located on the inner side of two opposite sidewalls, circular well bottoms **22** slightly raised from inner planar surface **14** and attachment posts **24** raised from the inner planar surface. Sidewalls **15, 16, 17** and **18** meet and are co-planar with inner planar surface **14.**

Sample distribution element **30** as shown in FIGS. 3, 3(a) and 3(b) comprises an upper surface **31,** a lower surface **32**, wells **34,** a trough **35,** a reservoir **36** and attachment bosses **38.** The sample distribution element is preferably disposed within the outer-base element.

Each well **34** in sample distribution element **30** is substantially disposed between upper surface **31** and lower surface **32** and transversely disposed with respect to trough **35.** Each well comprises a circular sidewall **39**, a sidewall bottom surface **37**, an upper mouth opening **40** and a bottom mouth opening **41**. Each well is substantially perpendicular to the trough to form a substantially sharp junction at the upper mouth opening. It is believed that the substantially sharp junction provides a means for effectively and efficiently separating individual aliquots from the sample.

Each well size may be varied by changing well cross-section or depth. The wells are shown in a circular configuration, but may have any cross-sectional geometry. The wells preferably are in a three by ten matrix

of thirty equal sizes as shown in FIG. 3(a). The bottom mouth opening of each well corresponds with a well bottom of the outer-base element as shown in FIG. 4.

Attachment posts **24** of the outer-base element mate with corresponding attachment bosses **38** on the sample distribution element to secure the sample distribution element to the outer-base element as also shown in FIG. 4.

Preferably the device is formed wherein sidewall bottom surface **37** and circular well bottom **22** are not sealed or fastened to each other. As shown in FIG. 4 the sidewall bottom surface and the well bottom are preferably substantially parallel to each other to form a variable space **26** between them for allowing only air to escape from the wells as sample enters.

Projections **25** may be on the periphery surface of well bottoms **22** as shown in FIG. 4(a) or as projections **44** on the periphery surface of the sidewall bottom surface **37** as shown in FIG. 4(b) so as to vary the space between the sidewall bottom surface and the well bottom. Most preferably, on the periphery surface of the well bottom or the sidewall bottom surface is a textured or abraded surface formed by abrasion, texturing, sanding or the like.

Sample distribution element **30** preferably comprises a reservoir **36** for receiving, distributing and/or storing liquid sample and/or for holding excess sample, which is connected to trough 35. Sample is poured or pipetted into the reservoir and then enters the trough. Preferably, the trough is a unidirectional pathway substantially perpendicular to the mouth opening of all the wells, ending at the last well and beginning at the reservoir.

Sample is distributed to each well by the trough by manually tilting the device slightly so that the sample in the reservoir flows in the trough. Once the sample has traveled to the last well, and if there is excess sample, the device is again tilted to make any undistributed sample pass back along the same path to the reservoir. The trough assures that a sample is allowed to pass over each well two times for complete filling. The sharp junction of the upper mouth opening and the trough provides a means for effectively and efficiently separating individual aliquots from the sample.

The sample flows from the upper mouth opening of each well through to the variable space between the sidewall bottom surface of the well and the well bottom after air has been expelled. It is believed that the weight of the sample forces the air or air bubbles to be pushed through the variable space. It is further believed that the combination of frictional forces, hydrostatic pressure differential and the sample surface tension prevents the sample from flowing beyond the variable space between the sidewall bottom surface of the well and the well bottom. Furthermore, the sample remains in the well and in the variable space between the sidewall bottom surface of the well and the well bottom even when the device is manipulated or inverted. The removal and prevention of air in each well allows for accurate, consistent and efficient testing and analysis of each aliquot.

The filling features of the present invention provide a means for distributing a small volume of an aliquot. The filling features are most useful when the upper mouth opening of each individual well is of a small diameter and/or the well circular sidewall is a small height. The small diameter of the upper mouth opening is allowed because of the function of the spaced means.

The upper mouth opening of each well is preferably from about 0.01 inches (0.03 cm) in diameter to about 0.25 inches (0.64 cm) and most preferably at about 0.16 inches (0.41 cm). Each well circular sidewall is preferably less than about 2 inches (5 cm) in height, desirably from about 0.04 inches (0.1 cm) to about 2 inches (5 cm) and most preferably at about 0.16 inches (0.41 cm).

The individual wells may also be coated with dried reagents that are reconstituted by the liquid sample or with immobilized reagents for solid phase tests.

As shown in FIG. 5, removable lid **50** comprises an upper surface **51**, a lower surface **52**, a depending edge **60** and depending sidewalls **54**, **55**, **56** and **57**. The removable lid also further comprises a plurality of projections **59** raised from lower surface **52** with a tip **61** on the unconnected end of each projection. Sidewalls **54**, **55**, **56** and **57** meet and are substantially coplanar with lower surface **52**. Depending edge **60** is substantially perpendicular to the sidewalls and follows the perimeter of upper surface **51**.

The lid removably covers the sample distribution element disposed within the outer base element. Sidewalls **54**, **55**, **56** and **57** and depending edge **60** serve to mate closely with outer-base element **11** forming a humidity control system for restricting evaporation of liquid from the device. Most preferably used to hold the lid and the outer-base element together are shelf-like projections **20** and **21** on the outer-base element and depending edge **60** on the lid.

As is shown in FIG. 5, various labels and identifying marks are preferably applied or molded into the lid of the device.

A most preferred embodiment of lid **50** is wherein a sponge or absorbent pad **70** is on the lower surface of the lid to draw up any excess sample from reservoir **36** of the sample distribution element as illustrated

in FIG. 5.

Each projection on the lid is preferably arranged to align with each well. As shown in FIG. 4, each projection is slightly smaller in dimension than each well upper mouth opening and is preferably of a length such that it just touches the surface of the liquid aliquot in each well after filling.

Tip **61** on each projection is preferably precoated with reagents for delivery to the aliquot in each well.

Each projection, preferably has a one-to-one correspondence with each well, to provide a means for each well to be separately and individually reacted with chemical reagents or other materials for typical analytical purposes.

The lid optionally has circular optical extensions **62** which are raised up from upper surface **51** of the lid and connected to a projection as shown in FIG. 5. Extensions **62** may be used to view an optical path for visual or machine examination of the sample through projections **59** and through the aliquot in the well to well bottom **22**.

The extensions and the projections serve to enhance the optical path of the device and eliminate problems from condensation common with simple lids due to their contact with the aliquot in each well. These components eliminate liquid to air and air to plastic interfaces in the viewing path of the well and the lid.

The lid optionally has a sealable opening **65** for adding liquid reagents to the aliquots in the wells. As shown in FIG. 6, the sealable opening is on the upper surface of the lid and may be effectively covered by sealing tape **66** affixed to the lid over opening **65**. The sealable opening is surrounded by a funnel area **67** for easy access of reagent to be added to the opening. The tape can be removed by use of a tape pull tab which is not sealed to the lid. Liquid sample is dispensed into the opening and flows through the funnel and then to a conduit **64** which is molded into the lower surface of the lid and connected to the opening. Each conduit is preferably rectangular in cross section and directs flow of the sample to projection **59**. In this embodiment, the projection further comprises a concave surface **63** for receiving liquid reagents for delivery or drying. Sealable opening **65** and conduit **64** may be connected to more than one projection to add a single reagent to multiple sample aliquots in their individual wells.

Additionally, lid **50** serves to protect the user from the contents of the device should it contain a harmful or potentially harmful material such as a microorganism suspension. In the preferred embodiment, sidewalls **54**, **55**, **56** and **57** extend beyond projections **59** to form a barrier to the loss of fluid by evaporation when fitted into the device of the outer-base element and over the sample distribution element. The lid sidewalls further function to protect precoated projections from the outside environment prior to use. The sidewalls may also hold a removable seal element that protects the projections.

The device may be used for the rapid separation of a sample into numerous aliquots and the treatment of any or all of the aliquots with the same or different reagents, substrates or other chemical additives.

The device is suitable for identifying microbes such as E. coli and Klebsiella pneumoniae in sample aliquots. Substrates useful for the identification or differentiation of microbes may be added to each aliquot by manual pipetting or by using the lid projections of the device. Interaction of an organism and the substrate may be for example, detected by a chemical or optically detectable change such as color of the aliquot. Other identifying and differentiating methods may use the removable lid to deliver substrates to each aliquot to produce distinct reactions in each aliquot.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof.

The example is not limited to any specific embodiment of the invention, but is only exemplary.

EXAMPLE 1

METHOD AND APPARATUS FOR PRODUCING MULTIPLE ALIQUOTS PIPETTE FILLING VS DIRECT FILLING

Two devices A and B of the present invention molded of Polysar 555 polystyrene were utilized to demonstrate the ability of the invention to produce essentially equal aliquots of a sample. The units were first analyzed by recording their optical density in a dry state using a spectrophotometer (Dynatech Model MR700, Dynatech Laboratories, McLean VA) to make readings at 560 nanometers.

A solution of phenol red dye was prepared by dissolving 0.047 gm in 100 ml of a 0.067M phosphate buffer at pH 7.5. A pipette was utilized to dispense 0.0060 ml of the dye solution onto the projections of lid A. Sample distribution element A was filled with the dye solution and then covered with lid A.

Sample distribution element B was directly filled with a 10:1 dilution of the dye and covered with lid B which had no solution on the projections.

Table 1 shows the measured mean and standard deviations from the mean measured for each device.

Table 1

Device	Mean OD at 560 NM	Standard Deviation	Coefficient of Variation (%)
A	1.357	0.053	3.9%
B	1.171	0.015	1.3%

The procedure of dispensing the dye by pipette yielded a slightly higher coefficient of variation than direct filling. This is, in part, due to the relative difficulty of pipetting such small volumes. The coefficient of variation of less than 2% for device B, and less than 4% for device A, are adequately reproducible for procedures in analytical microbiology. This example also demonstrates the use of the lid projections to receive a liquid reagent, have reagent dried for storage and then have said dried reagent be reproducibly delivered and rehydrated or dissolved in the equal volume aliquots produced by the invention. Time required to produce the sample aliquots using the device of the present invention was less than 30 seconds.

Claims

1. A device for dividing a sample into aliquots without air entrapment and for retention of aliquots therein, comprising:

   a housing; and

   a body associated with said housing for guiding a sample into a plurality of wells without air entrapment and for retaining said sample in said wells.

2. The device of Claim 1 further comprising a closure for supplying reagents to each well.

3. A device for dividing a sample into aliquots without air entrapment, comprising:

   an outer-base element comprising a bottom, an inner planar surface, sidewalls depending from said bottom and substantially perpendicular to said inner planar surface, and individual well bottoms raised from said inner planar surface; and

   a sample distribution element associated with said outer-base element comprising an upper surface, a lower surface, a trough on said upper surface comprising an unidirectional pathway, a reservoir adjacent to said trough, and each well comprising a sidewall, a sidewall bottom surface, an upper mouth opening and a bottom mouth opening wherein each well is disposed between said upper and lower surfaces and transversely disposed with respect to said trough to form a substantially sharp junction,

   wherein said sidewall bottom surface and well bottom of each well are substantially parallel to each other and form a spaced means to allow the escape of air.

4. The device of Claim 3 further comprising:

   a plurality of posts projecting from said inner planar surface of said outer-base element; and

   a plurality of corresponding bosses depending from said lower surface of said sample distribution element,

   wherein said posts and corresponding bosses engage to connect said outer-base element and said sample distribution element.

5. The device of Claim 3 wherein said sample distribution element is substantially rectangular in shape and said wells are in an ordered array of substantially parallel rows.

6. The device of Claim 3 further comprising a removable lid comprising an upper surface, a lower surface, sidewalls adjacent to said upper surface and coplanar to said lower surface, a plurality of projections depending from said lower surface and a depending edge adjacent to said upper surface and substantially perpendicular to said sidewalls.

7. The device of Claim 6 wherein said projections fit within said upper mouth opening of said wells in said sample distribution element.

8. The device of Claim 6 further comprising an extension raised from said upper surface for viewing said projections.

9. The device of Claim 6 further comprising:

an opening on said lid upper surface; and

a conduit on said lid lower surface connected to said opening and to said projection.

10. A method for identifying microbes comprising:
(a) distributing liquid sample without air entrapment into a multiple aliquot device comprising an outer-base element, a sample distribution element associated with said outer-base element and a lid removably covering said outer-base element and said sample distribution element;
(b) subjecting said sample to at least one substrate useful for identifying and detecting microbes; and
(c) examining said sample for chemical or optically detectable change.

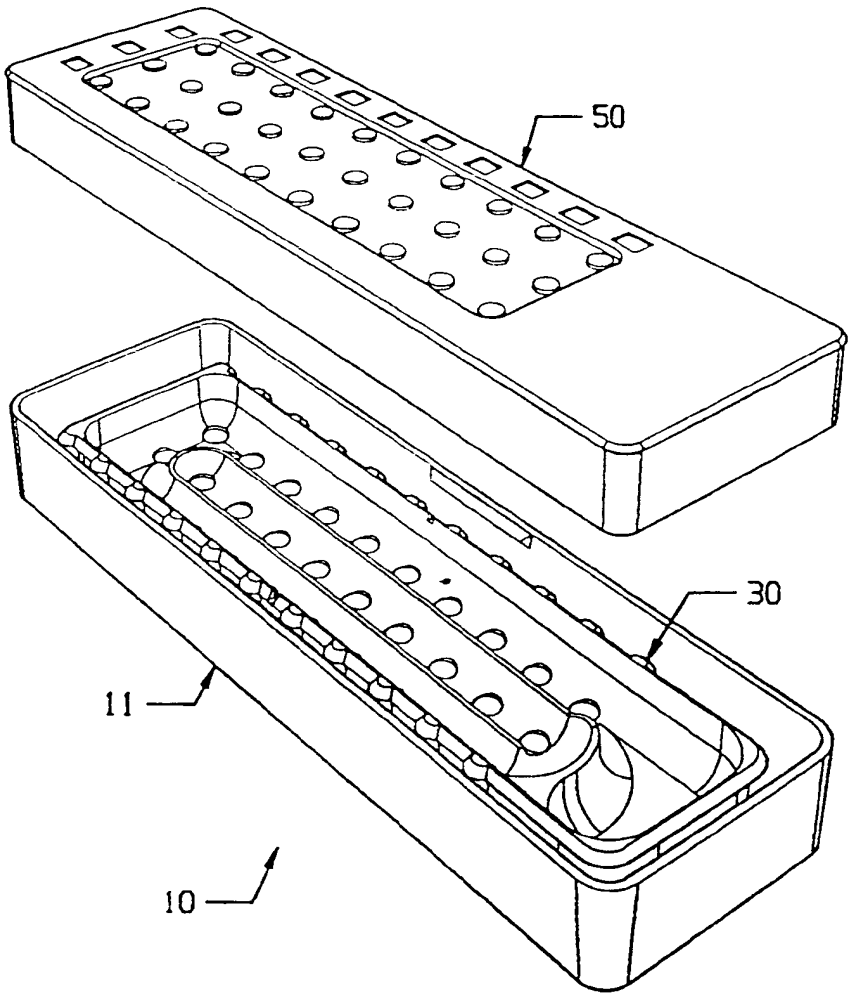

FIG. 1

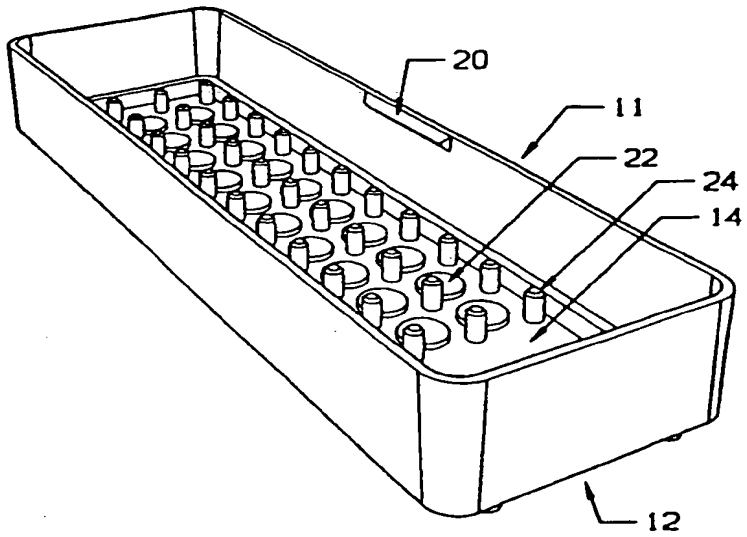

FIG. 2

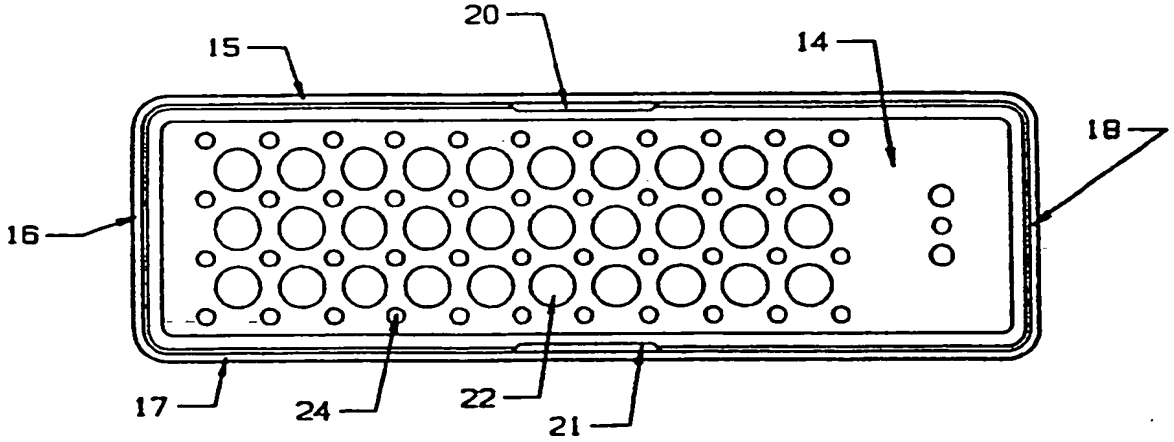

FIG. 2A

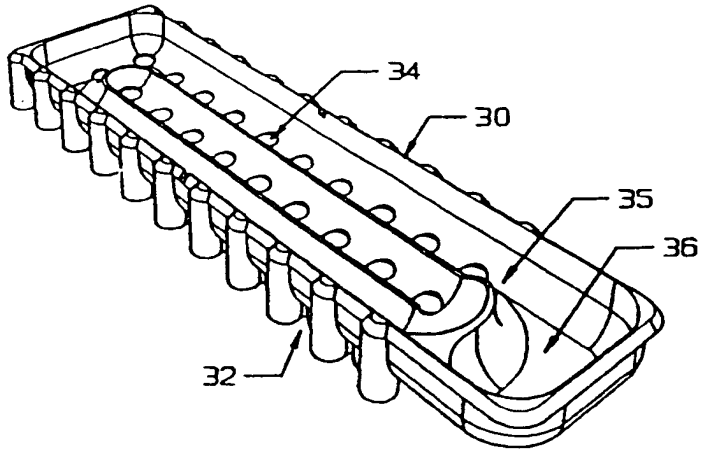

FIG. 3

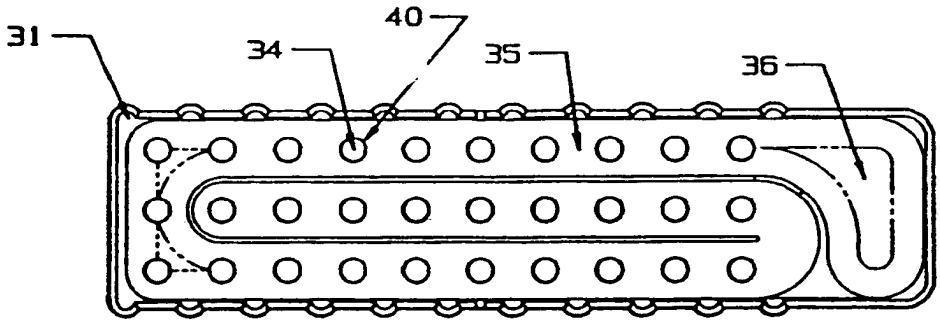

FIG. 3A

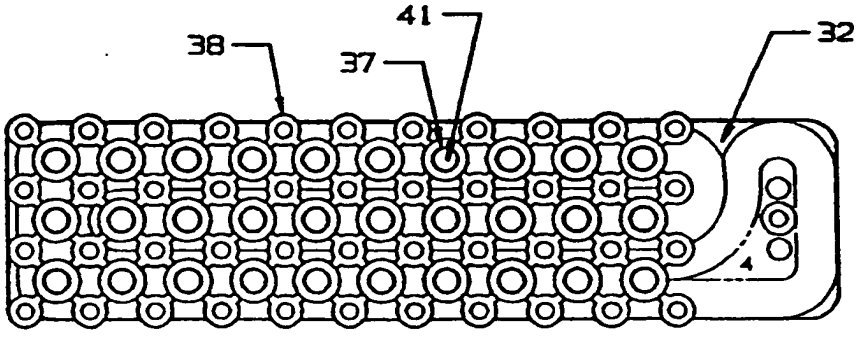

FIG. 3B

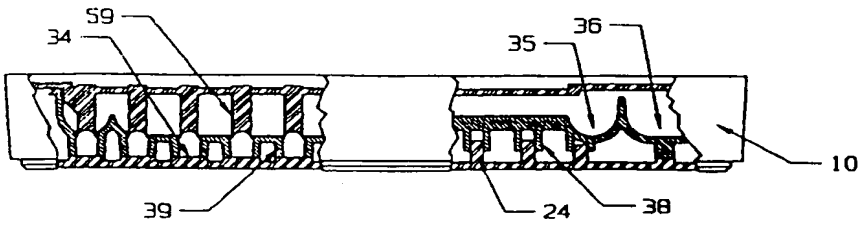

FIG. 4

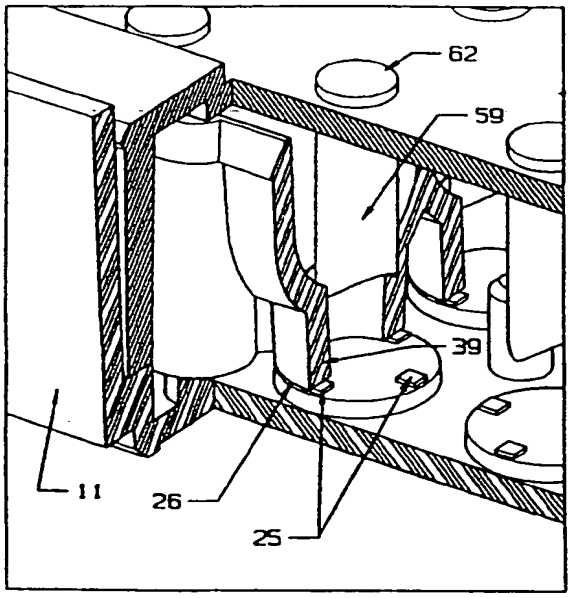

FIG. 4A

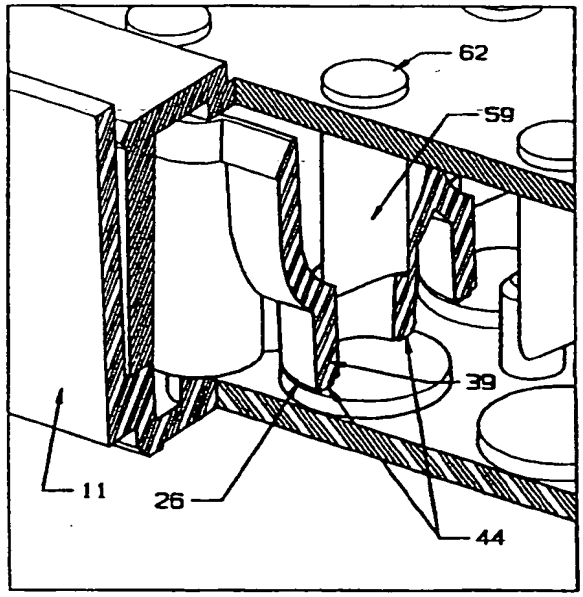

FIG. 4B

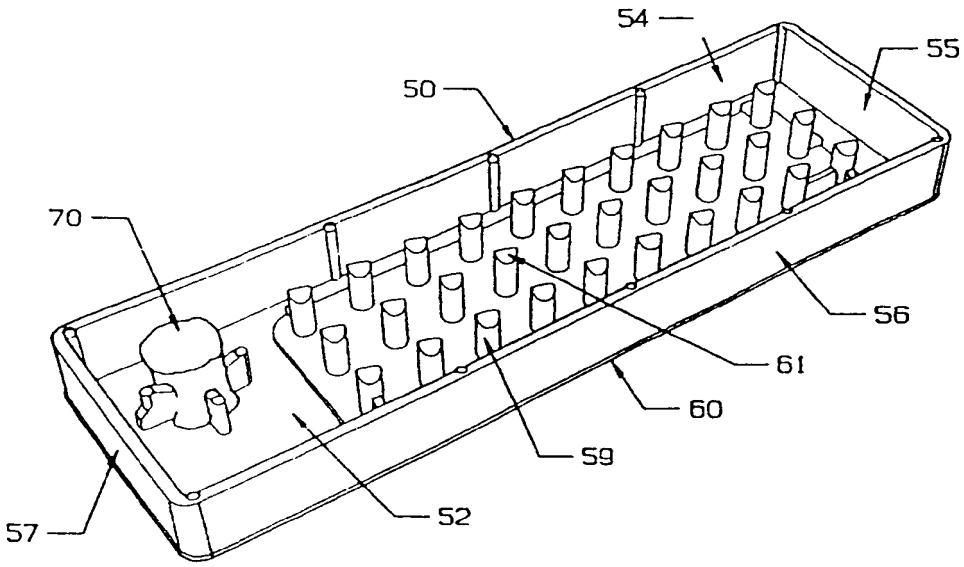

FIG. 5

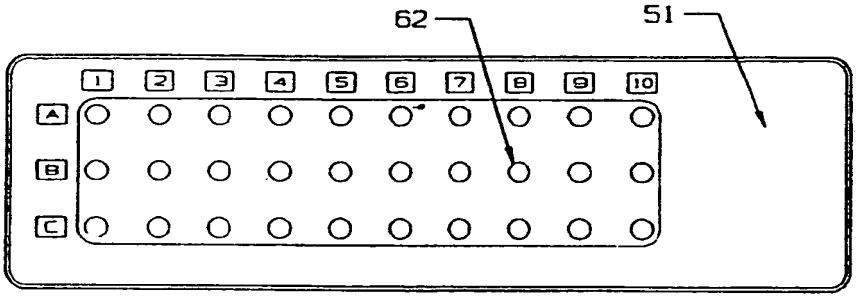

FIG. 5A

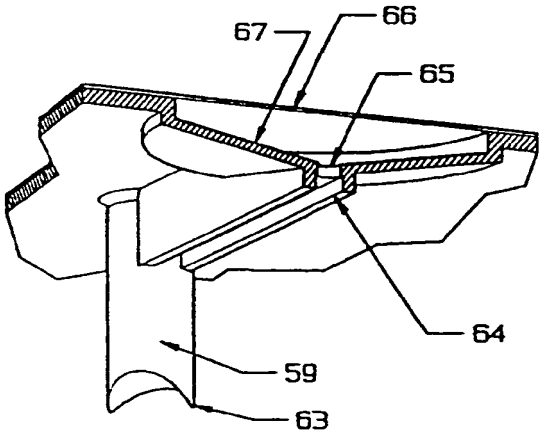

FIG. 6

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(54) Multiple aliquot device.

(57) The present invention is a device which allows for receiving, distributing and storing a sample into numerous aliquots of small volume without air entrapment and with retention of aliquots when the device is manipulated. The device allows for the treatment of any or all of the aliquots with the same or different reagents and/or other chemical additives. The device comprises a housing for containing a body for guiding a sample into a plurality of wells without the need for pipetting aids, without multiple manipulations, without the retention of air and for retaining sample in the wells.

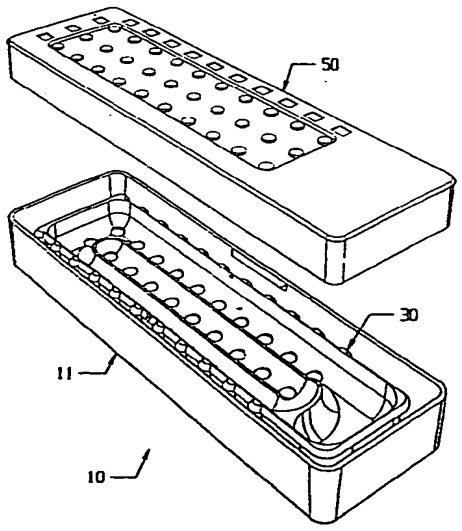

FIG. 1

EP 0 496 200 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 10 0133

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	GB-A-1 572 596 (THE OPTO ELECTRONIC DISPLAYS LIMITED) * the whole document *	1-10	C12M1/32 B01L3/00 G01N1/18
Y	US-A-4 077 845 (L.C. JOHNSON) * the whole document *	1-10	
A	GB-A-1 522 128 (J.T. BENNETT) * the whole document *	1,3-7, 9-10	
A	FR-A-2 440 400 (H.E. MEUNIER) * page 4, line 2 - page 5, line 21 * * page 7, line 19 - page 9, line 7; figures *	1,3,10	
A	US-A-4 195 060 (H.S. TERK)		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

C12M
B01L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	02 OCTOBER 1992	BEVAN S.R.

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